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Au-Ag Alloy Static High Pressure EOS measurements: FY09
summary of results

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Disclaimer

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Au-Ag Alloy Static High Pressure EOS measurements: FY09 summary of results

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Static high-pressure measurements of the equation of state of a Gold-Silver alloy (23.5 wt-% Ag) at room temperature were performed up to a pressure of approximately 100 GPA (1 megabar). Measurements were made using an energy-dispersive x-ray diffraction method. The data was analyzed, yielding crystal structure lattice constants and volume/density as a function of pressure. The results are extremely precise yielding accuracy of better than 1%.

The experiments were carried out at the HPCAT 16BM-D beamline at the Advanced Photon Source. Two experiments on separate samples were carried out using conventional membrane diamond anvil cells. To achieve hydrostatic conditions, we loaded a 50-100 micron piece of the Au-Ag alloy into the cell and surrounded it with neon and mineral oil pressure media in the respective experiments. The differing pressure media demonstrated no measureable difference on the resultant crystal structures, lattice constants or pressure-volume curves.

Results of our work are shown in the figures below. Up to the maximum pressure of 100 GPa the sample remained in the face-centered cubic structure, e.g., we observed no change in crystal structure. EOS curves of silver and gold, taken from the literature, are shown for comparison. We fit our data to a Vinet EOS functional form, and the parameters for this EOS were found to be,

Reference (ambient pressure) volume, V_0=16.965435 Å^3
Reference (ambient pressure) density, ρ_0=16.14584 g/cm^3
Bulk Modulus, K_0=144 GPa
Bulk Mod Derivative, K_0'=5.66

As one might expect the Au-Ag alloy lies between the gold and silver EOS curves, and tracks more closely to the gold EOS. These data are useful in validating and developing predictive EOS models of the pressure-dependent behavior of Au-Ag alloys.

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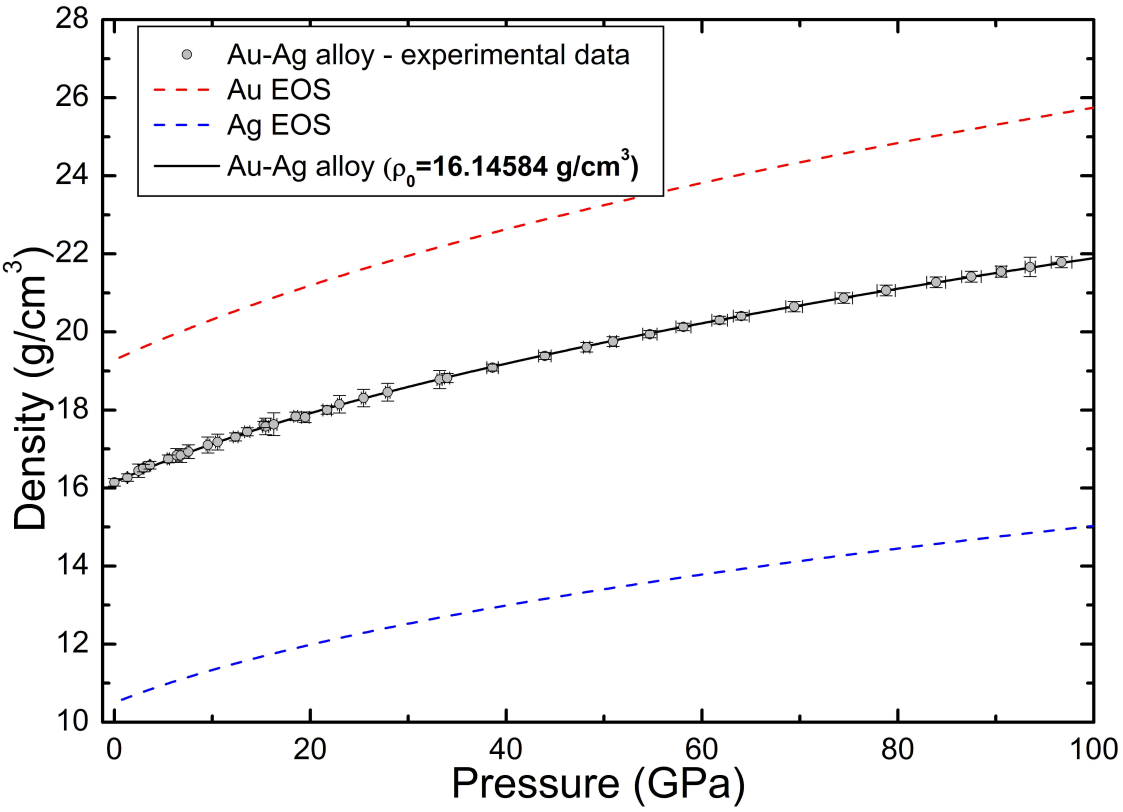

Figure 1. Density-Pressure plot for the Au-Ag Alloy (23.5 wt-% Ag). Pure silver and gold EOS curves are shown for reference.

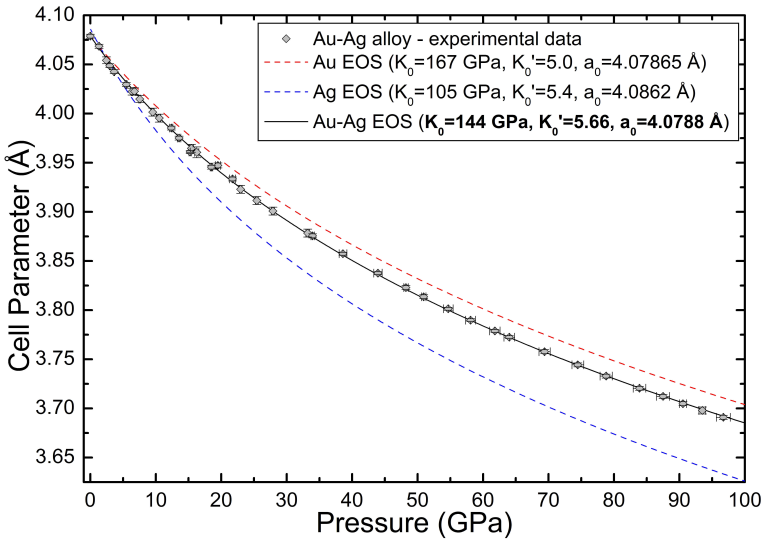

Figure 2. Cell Parameter-Pressure plot of Au-Ag alloy (23.5 wt-% Ag) in the FCC structure. Pure silver and gold EOS curves are shown for reference.

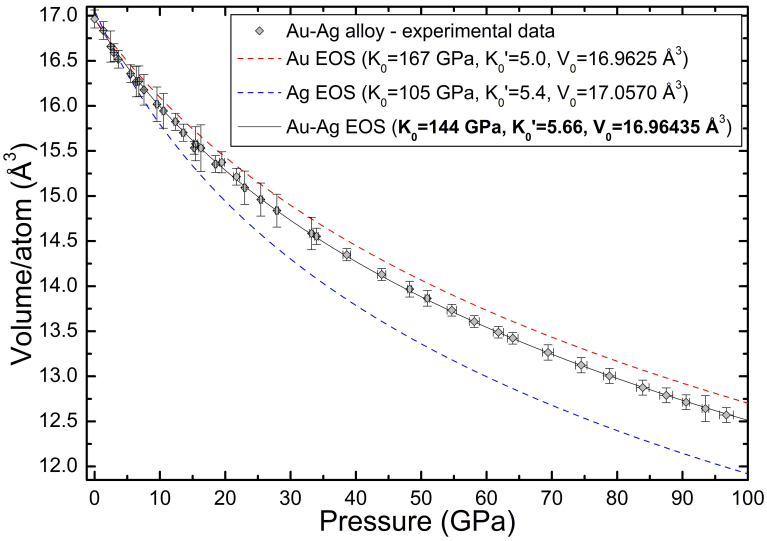

Figure 3. Volume-Pressure plot of Au-Ag alloy (23.5 wt-% Ag). Pure silver and gold curves are shown for reference.